WHAT IS CLAIMED IS:

1. A method of forming an array of polymers on a surface of a substrate, comprising:

providing a substrate having a first surface coated with functional groups protected with a photolabile protecting group, and a second surface having a layer disposed thereon, said layer including one or more of an index matching compound, a light absorbing compound and an antireflective compound; and

sequentially activating and coupling monomers in different selected regions of said substrate to form a plurality of different polymer sequences in different known locations on said surface of said substrate, wherein said activating step comprises directing an activation radiation at said first surface of said substrate.

2. The method according to claim 1, wherein said layer disposed upon said second surface of said substrate comprises an index matching compound.

3. The method according to claim 1, wherein said layer disposed upon said second surface of said substrate is an antireflective compound.

4. The method according to claim 1, wherein said layer disposed upon said second surface of said substrate comprises an index matching compound and a light absorbing compound.

5. The method according to claim 1, wherein said layer disposed upon said second surface of said substrate comprises polyimide.

6. The method according to claim 1, wherein said plurality of different polymer sequences comprises a plurality of different oligonucleotide sequences.

7. A method of forming a plurality of individual polymer arrays, comprising:

providing a plurality of substrate wafers, each of said substrate wafers having a first surface, said first surface having functional groups disposed thereon, said functional groups being protected with a removable protecting group;

exposing a plurality of first selected regions on said first surface of each of said substrate wafers to an activator at an activation station to remove said removable protecting groups from said functional groups in said first selected regions;

first moving said substrate wafers batch-wise to a coupling station;

contacting said plurality of wafers with a monomer containing solution at said coupling station, to couple first selected monomers to said functional groups in said selected regions on said surface of said plurality of substrate wafers;

first returning said substrate wafers batch-wise to said activation station;

exposing a plurality of second selected regions on said first surface of each of said substrate wafers to an activator at said activation station to remove said removable protecting groups from said functional groups in said second selected regions;

second moving said substrate wafers batch-wise to said coupling station;

contacting said plurality of wafers with a monomer containing solution in said coupling station, to couple second selected monomers to said functional groups in said selected regions on said surface of said plurality of substrate wafers;

repeating said exposing and contacting steps to form a plurality of individual polymer arrays on said first surface of each of said substrate wafers.

8. The method according to claim 7, wherein said contacting steps comprise simultaneously contacting said

plurality of substrate wafers with said monomer containing solutions.

9. The method according to claim 7, wherein said removable protecting group is a photolabile protecting group and said activator is light.

10. The method according to claim 7, wherein said exposing step comprises simultaneously contacting at least a first of said plurality of substrate wafers with a first monomer containing solution and contacting a second of said plurality of substrate wafers with a second monomer containing solution.

11. The method according to claim 7, wherein said activator comprises an activation radiation and said exposing step comprises directing said activation radiation at said first surface of said plurality of substrate wafers, and wherein a second surface of said plurality of substrate wafers includes a layer of one or more of an index matching compound, a light absorbing compound and an antireflective compound disposed thereon.

12. The method according to claim 11, wherein said layer disposed upon said second surface of said substrate comprises an index matching compound.

13. The method according to claim 11, wherein said layer disposed upon said second surface of said substrate is an antireflective compound.

14. The method according to claim 11, wherein said layer disposed upon said second surface of said substrate comprises an index matching compound and a light absorbing compound.

15. The method according to claim 11, wherein said layer disposed upon said second surface of said substrate comprises polyimide.

16. The method according to claim 7, wherein said plurality of different polymer sequences comprises a plurality of different oligonucleotide sequences.

17. A method of forming an array of polymers on a surface of a substrate, comprising:

derivatizing said surface of said substrate by contacting said surface of said substrate with a solution of aminoalkyltrialkoxysilane to provide amine functional groups on said first surface of said substrate;

protecting said functional groups with a protecting group;

activating first selected regions on said first surface of said substrate by removing said protecting groups from said functional groups in said first selected regions;

coupling a first monomer to said functional groups in said first selected regions;

activating second selected regions on said first surface of said substrate by removing said protecting groups from said functional groups in said second selected regions;

coupling a second monomer to said functional groups in said second selected regions;

repeating said activating and coupling steps to form a plurality of different polymer sequences, each of said different polymer sequences being coupled to said surface of said substrate in a different known location.

18. The method according to claim 17, wherein said first and second monomers coupled in said coupling steps comprise an active phosphoramidite group.

19. The method according to claim 17, wherein said first and second monomers comprise nucleosides.

20. The method according to claim 17, wherein said aminoalkyltrialkoxysilane is selected from the group consisting of 3-aminopropyltriethoxysilane and 3-aminopropyltrimethoxysilane.

21. The method according to claim 17, wherein in said derivatizing step, said contacting of said surface of said substrate with a solution of aminoalkyltrialkoxysilane is carried out by controlled vapor deposition of said aminoalkyltrialkoxysilane on said surface.

22. The method according to claim 17, wherein said plurality of different polymer sequences comprises a plurality of different oligonucleotide sequences.

23. A method of forming an array of polymers on a surface of a substrate, comprising:

stripping said surface of said substrate with a stripping solution;

providing functional groups on said surface of said substrate;

protecting said functional groups with a photolabile protecting group;

exposing first selected regions on said first surface of said substrate to an activation radiation to remove said photolabile protecting groups from said functional groups in said first selected regions;

coupling a first monomer to said functional groups in said first selected regions;

exposing second selected regions on said first surface of said substrate wafers to an activation radiation to remove said photolabile protecting groups from said functional groups in said second selected regions;

coupling a second monomer to said functional groups in said second selected regions;

repeating said exposing and coupling steps to form a plurality of different polymer sequences, each of said different polymer sequences being coupled to said surface of said substrate in a different known location.

24. The method according to claim 23, wherein said stripping step comprises contacting said surface of said substrate with a stripping solution of concentrated $NaOH/H_2O_2$.

25. The method according to claim 23, wherein said stripping step further comprises:

contacting said surface of said substrate with base; and

rinsing said substrate with acid.

26. A method of coupling monomers to selected regions on a surface of a substrate, comprising:

providing functional groups on said surface of said substrate, said functional groups being protected with a photoprotecting group;

exposing said selected regions to an activation radiation to remove said photolabile protecting group in said selected regions, said exposing step comprising directing an activation radiation at said selected regions on said surface of said substrate by shining said activation radiation through a photolithographic mask, said photolithographic mask including transparent regions and opaque regions, said transparent regions being smaller than said selected regions, whereby when said activation radiation is shone through said transparent regions in said mask, said activation radiation is diffracted to expose substantially all of said selected regions; and

coupling monomers to said functional groups in said selected regions.

27. The method according to claim 26, wherein said transparent regions in said mask are from about 2% to about 25% smaller in each dimension than said selected regions.

28. The method according to claim 26, wherein said transparent regions in said mask are from about 10% to about 20% smaller in each dimension than said selected regions.

29. A method of forming polymer sequences on a solid substrate, comprising:

providing functional groups on said surface of said substrate;

coupling monomers to said functional groups on said surface of said substrate, said monomers having chemical groups reversibly coupled thereto, whereby said chemical groups enhance the lipophilicity of said monomers.

30. The method according to claim 29, wherein said monomer comprises a nucleotide protected with a lipophilic protecting group.

31. The method according to claim 30, wherein said lipophilic protecting group is coupled to an exocyclic functional group in a nucleobase in said nucleotide.

32. The method according to claim 31, wherein said exocyclic functional group is protected with a DMT protecting group.

33. The method according to claim 30, wherein said lipophilic protecting group is a photolabile protecting group.

34. The method according to claim 30, wherein said monomer comprises a nucleoside Fmoc-phosphoramidite.

35. A method of deprotecting an array of polymer sequences synthesized on a solid support, comprising contacting said array with a solution containing a substituted alkylamine.

36. The method according to claim 35, wherein said substituted alkylamine is selected from the group consisting of ethanolamine and ethylenediamine.

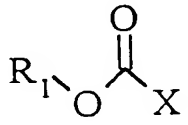
37. The method according to claim 35, wherein said solution of substituted alkylamine is a solution of ethylenediamine in ethanol.

38. The method according to claim 35, wherein said solution containing alkylamine is a 1:1 solution of ethylenediamine in ethanol.

39. A method of forming an array of polymer sequences on a surface of a substrate by sequentially deprotecting and coupling monomers in selected regions of said surface of said substrate to produce a plurality of different polymer sequences in different known locations of said surface of said substrate, the method comprising aligning deprotection and coupling steps in adjacent selected regions to minimize a number of differential synthesis steps between said adjacent regions.

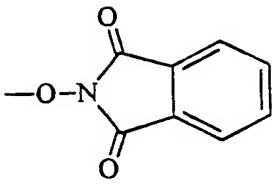
40. A method of forming an array of polymer sequences wherein each polymer sequence has a subsequence of monomers common to a sequence that is complementary to a target sequence, but wherein at least one position within said subsequence is substituted with each member of a basis set of monomers, the method comprising coupling all monomers in a same layer of a first of said polymer sequences in a same synthesis cycle as corresponding monomers in a second of said polymer sequences.

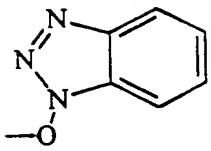
41. A method of photoprotecting a functional group coupled to a solid support, the method comprising exposing said functional group to a photoprotecting group transfer agent having the formula:

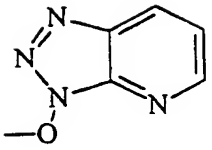


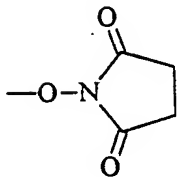
wherein R_1 is a photolabile protecting group and X is a leaving group.

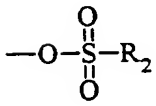
42. The method according to claim 41, wherein X is selected from the group consisting of:

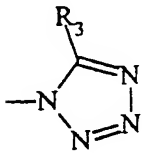


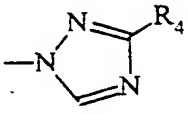


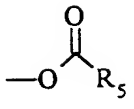












3

$$—O—R_6 \qquad —S—R_6$$

4

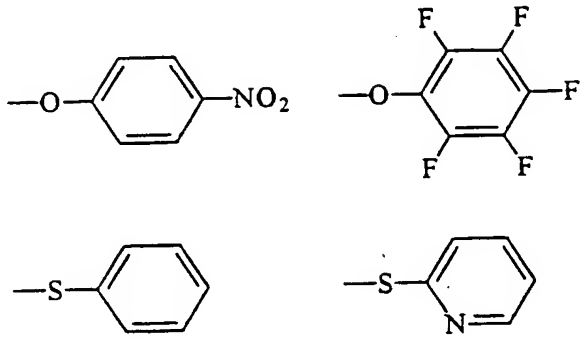
5

6 where R_2 is alkyl, substituted alkyl or aryl, R_3 is hydrogen,
7 alkyl, thioalkyl, aryl; R_4 is an electron withdrawing group;
8 R_5 is a sterically hindered alkyl or aryl group; and R_6 is
9 alkyl or aryl group said alkyl or aryl group comprising an
10 electronegative substituent.

1 43. The method according to claim 42, wherein R4 is
2 selected from the group consisting of NO2, SO_2-R_2, and CN.

1 44. The method according to claim 42, wherein R5 is
2 selected from the group consisting of adamantyl and t-butyl.

45. The method according to claim 42, wherein said electronegative substituent is selected from the group consisting of:



46. The method according to claim 41, wherein R_1 is selected from the group consisting of NVOC, NPOC, MeNVOC, MeNPOC, PYMOC, NV, NP, MeNV and MeNP.

47. The method according to claim 41, wherein said exposing step is carried out in the presence of a non-nucleophilic organic solvent and a base catalyst.

48. The method according to claim 47, wherein said non-nucleophilic organic solvent is selected from the group consisting of DMF, NMP, DCM, THF and ACN.

49. The method according to claim 47, wherein said base catalyst is selected from the group consisting of pyridine, 2,6-lutidine, TEA and DIEA.